Name of Organization: USACE, Research and Development Center

Type of Organization: Federal Agency

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Project Title: Contaminant Bioavailability in Remediated Dredged Material

Project Category: Contaminated Sediments

Rank by Organization (if applicable): 0

Total Funding Requested ($): 185,251 **Project Duration:** 2 Years

Abstract:

Dredged material placement in confined disposal facilities (CDF) is becoming more restrictive as current CDFs are filled to capacity and space for new CDFs is at a premium. A feasible alternative is the reuse of dredged material as a beneficial soil product for brownfield and landfill restoration, site development, landscaping and other uses where commercial soil products are used. One obstacle in the way of this progressive approach to dredged material management is the limitation some states place on dredged material reuse where low level contaminants are present. In many cases, soil screening levels based extremely conservative risk factors, are used to determine acceptable levels. Various low-cost remediation approaches (bioremediation and phytoremediation) to reduce dredged material contaminants are proving successful. However, some contaminant concentration goals set by states are extremely difficult to obtain in a reasonable amount of time. This study will address this problem in terms of bioavailability to soil invertebrates and transfer through plant uptake rather than soil concentration. Earthworm and plant bioassay procedures, currently used as part of a standard testing protocol for the assessment of dredged material disposal alternatives, will be used. This approach will determine the effectiveness of dredge material remediation efforts currently ongoing at Milwaukee and Green Bay CDFs. Bioavailability of metals, polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) from unremediated and remediated dredged material from both CDF locations will be determined. Remediated dredged material will include three separate treatments currently being used. Results will be compared to bioavailability of contaminants from a blend of locally available soil products sold in retail markets. Interpretive guidance will be provided to facilitate the use of bioavailability testing as a determination of beneficial use suitability.

Geographic Areas Affected by the Project

States:

- ☐ Illinois
- ☐ Indiana
- ☐ Michigan
- ☐ Minnesota
- ☐ New York
- ☐ Pennsylvania
- ☒ Wisconsin
- ☐ Ohio

Lakes:

- ☐ Superior
- ☐ Huron
- ☒ Michigan
- ☐ Erie
- ☐ Ontario
- ☐ All Lakes

Geographic Initiatives:

☐ Greater Chicago ☐ NE Ohio ☐ NW Indiana ☐ SE Michigan ☐ Lake St. Clair

Primary Affected Area of Concern:

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area:

Other Affected Biodiversity Investment Areas:

Problem Statement:

Various contaminants are a concern in dredged material proposed for placement in upland environments. This includes situations where dredged material is removed from a confined disposal facility (CDF) and used for various beneficial means. Dredged material is, in fact, displaced topsoil that has been recovered from waterways by dredging. However, the idea of returning it to the soil surface is met with resistance due to the presence of contaminants or simply the belief that the material is of no beneficial value. Many dredged materials can be very beneficial by returning nutrient rich soils to soil surfaces that are nutrient deficient, eroded, or are themselves more contaminated. The application of contaminated biosolids to farmland is allowable under USEPA 503 regulations and levels of contaminants allowed sometimes exceed the concentrations some states allow in dredged material removed from CDFs. However, dredged material is not subject to 503 regulations, as it is not a biosolid. Where dredged material is placed in terrestrial environments various contaminant pathways must be evaluated to determine the potential for adverse effects. The current approach for evaluating contaminant movement within upland pathways includes a plant bioassay and an earthworm bioassay to determine potential for adverse effects within upland food chains. Currently, regulatory limits on contaminants in ecosystem plants and animals do not exist and a risked-based approach to defining the potential for adverse effects must rely on the data generated by the plant and earthworm bioassays. This approach should also be applicable to evaluating remediated dredged material proposed for beneficial uses. However, current regulations set by many states rely solely on soil screening levels to determine beneficial use acceptance. An accepted protocol for determining bioavailability and biological risk in the beneficial use of dredged material is needed.

Proposed Work Outcome:

This study will determine the effectiveness of bioremediation on the bioavailability of contaminants from Green Bay and Milwaukee dredged materials and will describe the significance of accumulated contaminants in plant and animal pathways. The bioremediation of dredged material is being used to reduce contaminant levels in dredged material to satisfy State regulatory requirements. Requirements are based on soil concentration levels and do not consider realistic biological availability or contaminant stability as factors upon which to determine potential risk to various receptors. Elevated levels of some contaminants may not increase bioavailability to certain receptors while decreasing some contaminants below a certain soil concentration may not decrease the bioavailability to acceptable levels. Various soil characteristics, such as pH, cation exchange capacity, organic matter, etc., influence the bioavailability of contaminants and each soil or dredged material must be evaluated on a case-by-case basis to fully understand the risk each material poses and the appropriate risk management strategies necessary. This study will evaluate the basic food chain pathways necessary for the transfer of contaminants from soil materials to higher animals.

Materials will be collected from the Milwaukee and Green Bay CDFs, including both remediated dredged material from the

biopiles and unremediated dredged material. In addition, commercial soil products from local vendors will be blended and used for comparison. The materials will be placed in plastic 5-gal buckets and transported to the WES by overnight delivery. Each of the materials collected will be mixed thoroughly and samples will then be taken for chemical and physical characterization. The materials will be subjected to the WES plant and earthworm pathway testing. In addition, a new procedure that evaluates the plant to earthworm pathway will be conducted and compared to the results of the soil to earthworm pathway. Chemical analysis of Green Bay materials will include PCBs and metals while Milwaukee materials will be analyzed for PAHs and metals. The study will address the following pathways for each material tested: (1) soil to plant, (2) soil to earthworm, (3) plant to earthworm. The presence and concentration of contaminants in plants and earthworm tissues will be determined. The results will be statistically compared to the commercial soil product blend and as well as to background plant and earthworm contaminant levels. If contaminant bioavailability from the remediated dredged material is no greater than from the commercial soil product or the background concentrations where the dredged material would be used beneficially, then the dredged material should be considered acceptable for reuse.

This proposed work meets the three statemenst of need under contaminanted sediments: (1) data collection for risk/hazard assessments (2) bench pilot studies to supprt remedial efforts (3) beneficial reuse of sediments. The results of this study will quantify bioavailability of contaminants in Green Bay and Milwaukee dredged material and the effectiveness of bioremediation in reducing bioavailability. Results of contaminant bioavailability from commercial soil products will provide a comparison to a consumer soil material with no restrictions on use. The results can be used to argue for release of remediated dredged material for beneficial use. The removal of dredged material from current CDFs will allow for the placement of new dredged material in the future without constructing new CDFs and will provide a soil product for various commercial and municipal benefits.

Project Milestones:	**Dates:**
Collect dredged material	09/2000
Complete Plant Bioassays	12/2000
Complete Earthworm Bioassays	02/2001
Complete Chemical Analyses	05/2001
Background Plant and Earthworm Data	08/2001
Field Demo for beneficial use	08/2001
Draft Report	12/2001
Draft Journal Article	02/2002

☐ Project Addresses Environmental Justice

If So, Description of How:

☒ Project Addresses Education/Outreach

If So, Description of How:

Website links estabished by the Corps of Engineer, Detroit District and ERDC- WES.

Project Budget:

	Federal Share Requested ($)	Applicant's Share ($)
Personnel:	50,858	24,684
Fringe:	14,393	6,985
Travel:	2,000	4,500
Equipment:	0	10,000
Supplies:	0	5,000
Contracts:	0	30,000
Construction:	0	0
Other:	118,000	0
Total Direct Costs:	185,251	81,169
Indirect Costs:	0	0
Total:	185,251	81,169
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

The Detroit District has committed more than $290K toward remediation of Dredged material at Green Bay and Milwaukee CDFs and is committing $50K toward this proposed effort. The USERDC-WES is committing over $31K through facilities use, contract support and salaries through DOER funded projects.

Description of Collaboration/Community Based Support:

US Army Engineer District, Detroit
Milwaukee Port Authority
US Army Engineer Research and Development Center, WES